

APPLICATION UNDER UNITED STATES PATENT LAWS

Invention: **MULTI-USER HANDS-FREE WIRELESS TELEPHONE GATEWAY**

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This is a:

- ☐ [] Provisional Application
- ☒ [X] Regular Utility Application
- ☐ [] Continuing Application
- ☐ [] PCT National Phase Application
- ☐ [] Design Application
- ☐ [] Reissue Application
- ☐ [] Plant Application

SPECIFICATION

MULTI-USER HANDS-FREE WIRELESS TELEPHONE GATEWAY

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

This invention relates generally to wireless phones. More particularly, it relates to devices which permit hands-free wireless phone operation.

10 2. Background

Wireless telephones, including cellular phones, have proven to be immensely useful and important in today's society. Wireless phones can be seen in all walks of life: at the grocery store, in the park, and perhaps most prominently while driving or riding in a vehicle.

15 While the benefits of wireless phones are indisputable, there has been increasing concern over their use by drivers of vehicles. Concerns generally focus on the safety issues with respect to the need for a user to physically hold the wireless phone when using it in a vehicle.

As a result, several states have adopted new laws requiring
20 use of a hands-free unit by drivers. A hands-free unit essentially provides a speakerphone capability to a wireless phone, and also typically draws power from the vehicles battery, extending (and even re-charging) the wireless device's battery.

A typical hands-free unit for a vehicle (i.e., in-car
25 speakerphone) provides audio linkage between a wireless phone in the vehicle and a loudspeaker and microphone. For instance, some conventional 'wired' hands-free units physically connect and/or cradle a wireless phone, often providing power and intermixing the phone audio receive path with the stereo system of the vehicle, though not all

conventional hands-free units provide power and/or access to the stereo system.

As wireless phones proliferate in our society, it becomes more and more likely that multiple wireless phones may be utilized by separate persons within a single vehicle. While state laws typically relate only to drivers of the vehicle, it is often desirable to allow any wireless telephone within the vehicle to utilize the hands-free unit. This may be possible if all users within the vehicle have the same type wireless phone able to mate with the hands-free unit, but it is not always likely. Moreover, if another wireless phone is already mated with the hands-free unit, it is often easiest and most convenient to merely not utilize the hands-free unit and instead manually handle the wireless phone. Thus, use of a conventional hands-free unit is typically restricted only to the driver of a vehicle.

There is a need for a hands-free unit capable of providing efficient and convenient access to any wireless phone user who happens to be within the vehicle, in a manner which is safe and non-distracting to the driver of the vehicle.

SUMMARY OF THE INVENTION

In accordance with the principles of the present invention, a wireless hands-free device comprises a piconet front end adapted to establish an audio path with a wireless phone over a piconet network, and a speakerphone functionality module.

A method of providing hands-free functionality to one of a plurality of wireless phones participating in a piconet network in accordance with another aspect of the present invention comprises receiving a request for access to a wireless hands-free gateway from one of the plurality of wireless phones, and providing hands-free functionality to that wireless phone.

BRIEF DESCRIPTION OF THE DRAWINGS

Features and advantages of the present invention will become apparent to those skilled in the art from the following description with reference to the drawings, in which:

5 Fig. 1 depicts the presence of four wireless phones in a top view of a vehicle including a multi-user wireless hands-free gateway, in accordance with the principles of the present invention.

 Fig. 2 is a detailed block diagram of a multi-user wireless hands-free gateway in accordance with the principles of the present
10 invention.

 Fig. 3 is an exemplary vehicle control panel which, once trained with appropriate wireless phone lds (e.g., phone numbers), allows a driver of the vehicle to identify themselves as such so that their wireless phone is given priority usage of the vehicle's wireless multi-user hands-free unit, in accordance with the principles of the present invention.
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 Fig. 4 is an exemplary process flow chart showing the training of the vehicle control panel shown in Fig. 3.

 Fig. 5 is an exemplary process flow chart showing the usage of the wireless multi-user hands-free gateway by the driver of the vehicle, in accordance with the principles of the present invention.
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 Fig. 6 is an exemplary process flow chart showing the usage of the wireless multi-user hands-free gateway by a passenger of the vehicle, in accordance with the principles of the present invention.

 Fig. 7 is an exemplary process flow chart showing a first
25 option wherein the driver of the vehicle returns a busy or not available signal if an incoming call is received while another passenger in the vehicle is using the wireless multi-user hands-free gateway, in accordance with the principles of the present invention.

 Fig. 8 is an exemplary process flow chart showing a second
30 option wherein if an incoming call is received by the driver while another

passenger in the vehicle is using the wireless multi-user hands-free gateway, the passenger is directed to terminate use of the wireless multi-user hands-free unit (either by returning to hand mode or by terminating telephone call), to provide priority usage of the wireless multi-user hands-free gateway in accordance with the principles of the present invention.

Fig. 9 shows the use of a driver ID transponder to automatically inform the wireless multi-user hands-free gateway as to which user within range of the BLUETOOTH™ piconet is the driver of the vehicle, in accordance with the principles of the present invention.

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

A wireless multi-user hands-free gateway particularly suited for a vehicle. The wireless hands-free gateway is capable of wireless operation with any of a plurality of wireless phones established on a piconet network (e.g., a BLUETOOTH™ standard piconet network) within the vehicle. In the disclosed embodiments, the wireless multi-user hands-free gateway automatically identifies users within range, and preferably gives priority use to the user detected or otherwise identified to be the driver of the vehicle. All passengers other than the driver may be similarly prioritized and given access on a first come-first served basis.

Fig. 1 depicts the presence of four wireless phones in a top view of a vehicle including a multi-user wireless hands-free gateway, in accordance with the principles of the present invention.

In particular, Fig. 1 shows a wireless multi-user hands-free gateway unit **100** installed in a vehicle **101**. The hands-free gateway unit **100** may be installed in any convenient location within the vehicle **101**, e.g., in the center console, under the dashboard, etc.

The vehicle may accommodate any number of passengers in addition to the driver. The vehicle **101** shown in Fig. 1 accommodates three (3) passengers in addition to the driver. The driver uses a first

wireless phone **120a**, while the passengers use respective wireless phones **120b**, **120c**, **120d**.

In the given embodiments, the wireless phones (referred to collectively as **120**) communicate over a piconet (e.g., a BLUETOOTH™ piconet) established with the wireless multi-user hands-free gateway **100**.
5 Use of a wireless communication path between the wireless telephones and the BLUETOOTH™ piconet in the wireless hands-free gateway **100** has the advantage of connecting without any wires and without the user needing to do anything (except bring their wireless phone into the vehicle
10 **101**).

Each wireless phone **120** includes a wireless piconet front end in communication with a main processor (e.g., microcontroller, microprocessor, or digital signal processor (DSP)). In the given
15 embodiments, the wireless piconet front ends of both the wireless phones **120** and the wireless hands-free gateway **100** form a wireless piconet with one another.

Piconets, or small wireless networks, are being formed by more and more devices in many homes and offices. In particular, a popular piconet standard is commonly referred to as a BLUETOOTH™
20 piconet. Piconet technology in general, and BLUETOOTH technology in particular, provides peer-to-peer communications over short distances.

The wireless frequency of the piconets may be 2.4 GHz as per BLUETOOTH standards, and/or typically have a 20 to 100 foot range. The piconet RF transmitter may operate in common frequencies that do
25 not necessarily require a license from the regulating government authorities, e.g., the Federal Communications Commission (FCC) in the United States. Alternatively, the wireless communication can be accomplished with infrared (IR) transmitters and receivers, but this is less preferable because of the directional and visual problems often
30 associated with IR systems.

A plurality of piconet networks may be interconnected through a scatternet connection, in accordance with BLUETOOTH™ protocols. BLUETOOTH network technology may be utilized to implement a wireless piconet network connection (including scatternet). The
5 BLUETOOTH standard for wireless piconet networks is well known, and is available from many sources, e.g., from the web site www.bluetooth.com.

A dedicated one-to-one pairing of a wireless phone to a wireless hands-free gateway using a BLUETOOTH™ piconet is useful. The present invention provides a wireless hands-free gateway which may
10 also communicate with passengers' wireless phones **120b-120d** in addition to the driver's cell wireless phone **120a**.

In the given embodiments, the wireless multi-user hands-free gateway **100** provides only one audio path (i.e., only one set of
15 loudspeaker(s) and microphone), and thus a selection or arbitration among wireless phone members of the piconet must be made by the wireless multi-user hands-free gateway **100**, because more than one wireless phone may be in operation in the vehicle.

Since safety is of the utmost concern, it is desirable that the driver always has priority in using the hands-free gateway **100**. It is
20 generally considered not a hazard when a passenger talks on a hand-held mobile phone.

Fig. 2 is a detailed block diagram of a multi-user wireless hands-free gateway in accordance with the principles of the present invention.

In particular, Fig. 2 shows a wireless phone **120** including an otherwise conventional wireless phone functionality **225** in communication
25 with a BLUETOOTH™ piconet front end **232**. The BLUETOOTH™ piconet front end **232** may communicate with a processor in the wireless phone functionality **225** using any suitable communication device and
30 standard, serial or parallel.

The wireless phones **120** each establish a piconet network with the wireless multi-user hands-free gateway **100**, which includes a BLUETOOTH™ piconet front end **230**, a loudspeaker **250** (or interconnection to the vehicle's sound system), a microphone **250**, and a suitable audio echo canceller **240**. The audio echo canceller **240** provides cancellation of feedback components picked up by the microphone **260** from being output from the loudspeaker **250**.

The wireless multi-user hands-free gateway **100** also includes the identification of the driver's wireless phone so that priority usage can be given to the driver of the vehicle **101**. While any unique identifier may be used, the telephone number of the driver's wireless phone **120a** is used and stored in an appropriate register or memory location **270** in the given embodiments.

The selection of a particular driver may be performed using any suitable technique. For instance, the telephone number of possible drivers may be programmed and stored in the driver ID module **270** using any suitable keypad in the vehicle in communication with the wireless hands-free gateway **100**.

Fig. 3 is an exemplary vehicle control panel which, once trained with appropriate wireless phone IDs (e.g., phone numbers), allows a driver of the vehicle to identify themselves as such so that their wireless phone is given priority usage of the vehicle's wireless multi-user hands-free unit, in accordance with the principles of the present invention.

In particular, Fig. 3 shows a control panel including two push-buttons **202**, **204** corresponding to two possible drivers of the vehicle **101** in which it is installed. In the given embodiment, each push-button is initially trained to correspond to a particular driver's ID (e.g., their wireless phone number). Thereafter, a driver selects the correct button **202** or **204** corresponding to their wireless phone to gain priority use of the wireless multi-user hands-free gateway **100**. Preferably, the driver

selects the correct button **202**, **204** before an incoming call is received by their wireless phone, so that priority access can be provided immediately upon receipt of the incoming phone call.

Fig. 4 is an exemplary process flow chart showing the training of the vehicle control panel shown in Fig. 3.

In particular, in step **302** of Fig. 4, a piconet network (e.g., a BLUETOOTH™ conforming piconet network connection is established between the wireless multi-user hands-free gateway **100** and the particular wireless phone **120** training the driver selection control panel **200**.

In step **304**, as part of the training process, the user is prompted to activate one of the buttons **202** or **204** on the driver selection control panel **200** to 'program' that particular button **202** or **204** with the identity (e.g., phone number) of that potential driver.

The same process is repeated for each potential driver to program the remaining buttons in the driver selection control panel **200**.

Instead of push-buttons **202**, **204** as shown in Fig. 3, a toggle button may be implemented that toggles between selections of wireless phones in the piconet network to identify which user is the driver. In another embodiment, a rotary or other multiple position switch may be implemented to select the identity of the driver.

While buttons and switches are shown in the embodiments of Figs. 2-4 to identify which wireless phone is the driver, any suitable indication of the driver's wireless phone with respect to other wireless phones in an established piconet network may be utilized. In accordance with the principles of the present invention, it is preferred that there be a clear indication presented to the wireless multi-user hands-free unit of which in-range user is the driver such that the wireless multi-user hands-free gateway **100** will properly provide hands-free capabilities to the desired wireless phone **120** in the vehicle **101** at the appropriate time.

In yet another embodiment, a user in a backseat or other passenger seat of the vehicle **101** may be provided with the ability to use the wireless multi-user hands-free gateway **100** via a control panel button presented near their passenger seat.

5 Alternatively, the driver identity selection may be performed using voice recognition. For instance, voice recognition may determine which of a known set of voices is speaking. In such an embodiment, the phone arbitration module **200** of the wireless multi-user hands-free gateway **100** may be first trained using various sentences spoken by each
10 possible user in the vehicle **101**.

 More advanced uses of voice recognition may also be implemented. For instance, the user of the wireless multi-user hands-free gateway **100** may speak the digits in a desired telephone number to be placed, with the digits being converted into numerals of a phone number
15 and communicated to a service provider to make the phone call.

 Referring back to Fig. 2, a phone arbitration module **220** arbitrates access and usage of the wireless multi-user hands-free gateway **100**, giving priority usage to the driver's wireless phone, and first come-first served priority to passengers in the vehicle other than the
20 driver. Preferably, acknowledgement of access to a particular wireless phone **120** is provided by the wireless hands-free gateway **100** back to the successful wireless phone **120** given access and use of the hands-free functionality of the wireless hands-free gateway **100**.

 The phone arbitration module **220** may be implemented as
25 software within a suitable processor. The functionality of the disclosed phone arbitration module **220** is shown and described with respect to Figs. 5 to 8.

 The driver selection control panel **200** may be located in any convenient location within the vehicle, e.g., on the steering wheel, in a
30 corner of the windshield, on one or more doors in the vehicle, etc.

In yet another embodiment, automatic designation of a particular user as a 'default' driver may be established, e.g., by the first user during the current drive to make use of the wireless hands-free gateway **100**.

5 Fig. 5 is an exemplary process flow chart showing the usage of the wireless multi-user hands-free gateway by the driver of the vehicle, in accordance with the principles of the present invention.

In particular, in step **402** of Fig. 5, an incoming call is received by the current driver of the vehicle **101**.

10 In step **404**, the driver's wireless phone **120a** establishes a BLUETOOTH™ audio connection with the wireless multi-user hands-free gateway **100**.

In step **406**, the driver's wireless phone **120a** signals the wireless multi-user hands-free gateway **100** to answer the incoming call.

15 In step **408**, while the driver utilizes the hands-free functionality of the wireless hands-free gateway **100**, all other wireless phones in the BLUETOOTH network (i.e., within the vehicle **101**) are not provided hands-free access, and thus must use their manual hands mode.

Fig. 6 is an exemplary process flow chart showing the usage
20 of the wireless multi-user hands-free gateway by a passenger of the vehicle, in accordance with the principles of the present invention.

In particular, in step **502** of Fig. 6, one of the passengers in the vehicle **101** receives an incoming call.

In step **504**, the passenger's wireless phone, under the
25 direction of the passenger, requests use of the wireless hands-free gateway **100**. Typically, this request may be performed by keypress on the passenger's wireless phone, but may alternatively be activated by a button mounted in the vehicle adjacent the passenger and in communication with the wireless hands-free gateway **100**.

In step **506**, if available (i.e., not currently being used), the wireless hands-free gateway **100** establishes a two-way BLUETOOTH™ audio connection with the requesting passenger's wireless phone.

5 In step **508**, the passenger's wireless phone signals the wireless hands-free gateway **100** to answer the incoming phone call.

In step **510**, while the passenger makes use of the hands-free functionality, all other passengers in the vehicle **101** are directed to use their manual mode (provided that all passenger's wireless phones are given equal priority and arbitration is provided on a first come-first served
10 basis).

Fig. 7 is an exemplary process flow chart showing a first option wherein the driver of the vehicle returns a busy or not available signal if an incoming call is received while another passenger in the vehicle is using the wireless multi-user hands-free gateway, in accordance
15 with the principles of the present invention.

In particular, in step **602** of Fig. 7, the driver of the vehicle **101** receives an incoming call while a passenger is using the hands-free functionality of the wireless hands-free gateway **100**. In accordance with the principles of the present invention, the driver is given priority usage of
20 the wireless hands-free unit or in any event hands mode is avoided for the driver.

To this end, step **604** shows that hands mode for the driver is avoided by returning a "busy", "not available" or similar signal back to its service provider. In the given embodiment, the caller receives a busy or
25 not available signal in accordance with otherwise conventional telephone standards.

Fig. 8 is an exemplary process flow chart showing a second option wherein if an incoming call is received by the driver while another passenger in the vehicle is using the wireless multi-user hands-free
30 gateway, the passenger is directed to terminate use of the wireless multi-

user hands-free unit (either by returning to hand mode or by terminating telephone call), to provide priority usage of the wireless multi-user hands-free gateway in accordance with the principles of the present invention.

5 In particular, in step **702** of Fig. 8, the driver receives an incoming call while a passenger in the vehicle **101** uses the wireless hands-free gateway **100**.

In step **704**, the driver's wireless phone **120a** establishes BLUETOOTH™ communications with the wireless hands-free gateway **100**.

10 In step **706**, the driver's wireless phone **120a** requests priority access to the wireless hands-free gateway **100** via communications over the established piconet network.

In step **708**, the active passenger terminates use of the wireless hands-free gateway **100** by transferring to manual, hands mode.

15 In step **710**, the driver's wireless phone **120a** signals the wireless hands-free unit **100** to establish a BLUETOOTH audio path therewith and to answer the incoming call.

In step **712**, while the driver uses the wireless hands-free gateway **100**, all passengers are preferably refused access to the wireless
20 hands-free gateway until the driver's wireless phone has relinquished access thereto.

The vehicle **101** may provide user identification, particularly the identity of the driver, in other physical ways. For instance, the particular user (of a given set of pre-programmed and/or pre-trained
25 possible users) may be identified, e.g., via a detected adjustment of the driver's seat, of a selected radio station, etc. Any physical technique may be implemented to determine which user is the driver of the vehicle **101**, in accordance with the principles of the present invention.

For instance, in another embodiment in accordance with the
30 principles of the present invention utilizes a key chain-mounted

electronically detectable tag to provide the identity of the driver of the vehicle.

Fig. 9 shows the use of a driver ID transponder to automatically inform the wireless multi-user hands-free gateway as to which user within range of the BLUETOOTH™ piconet is the driver of the vehicle, in accordance with the principles of the present invention.

In particular, Fig. 9 shows a key chain **810**-carried driver ID transponder **802** placed in proximity to a mating key/driver ID detector **804** when the owner's car key **812** is placed in the ignition **816** of the vehicle **101**. When the driver's key **812** is inserted into the ignition, their ID is detected by the key/driver ID detector **804**, and provided to the phone arbitrator module **220** of the wireless hands-free gateway **100** for storage in the driver ID register or memory **270**.

Any suitable detection technology may be implemented in the driver ID transponder **802** and key/driver ID detector **804**. For instance, suitable technology is disclosed in co-pending U.S. Appl. No. 09/783,101 entitled "Recharging Key Based Wireless Device", filed February 15, 2001 by Philip D. Mooney et al., the entirety of which is expressly incorporated herein by reference.

Implementation of a wireless hands-free gateway **100** in accordance with the principles of the present invention need not be limited to vehicles, but rather can be extended for use in homes and offices.

The wireless hands-free gateway **100** may be speech activated. For instance, key words may be pre-trained and used to select which wireless phone is requesting access to the wireless hands-free gateway **100**. For example, user one could say "Using Smith, call the office." The words "Using Smith" would select user one, and "call the office" would select the telephone number to call. These gateway selection key words may be configured and/or trained during piconet device pairing.

A wireless hands-free vehicle unit in accordance with the principles of the present invention improves safety by encouraging hands-free operation of wireless devices, particularly that of the driver. Moreover, such a hands-free unit would tend to increase usage of wireless services by making calling more convenient. Preferably, the multi-user wireless hands-free unit enhances the user's experience by making user selection automatic. It also has the capability of providing accurate usage information by allowing co-workers in a common vehicle to share a single hands-free unit, thus eliminating the need for a secondary user to borrow another's phone which mates with a single conventional hands-free unit.

The present invention can be adapted for use in car rentals, allowing generic hands-free capabilities to all travelers. It also allows for hands-free conference calls in a vehicle.

While the invention has been described with reference to the exemplary embodiments thereof, those skilled in the art will be able to make various modifications to the described embodiments of the invention without departing from the true spirit and scope of the invention.